IN THE CLAIMS

The claims pending in the application are reproduced below in accordance with 37 C.F.R. § 1.121:

1. (currently amended) A vibration control system for a rotary machine having a rotor, comprising:

a sensor disposed within the rotary machine for sensing vibration of the rotor;

a vibration damping device disposed within the rotary machine for imparting a reaction force to the rotor; and

a controller arranged in operable communication with said sensor and said vibration damping device, said controller adapted to receive a sensor signal from said sensor and to send a control signal to said vibration damping device for damping the vibration of the rotor, wherein the control signal to said vibration damping device is adapted to adjust an excitation of said vibration damping device based~~on a difference between the vibration of the rotor sensed by said sensor and an output response of the rotor vibration calculated by said controller~~ upon the following relationship

H(s) = X1(s) / F(s);

wherein H(s) is a system transfer function, X1(s) is a calculated system output response and F(s) is a vibration frequency input based upon said sensor signal.

2. (original) The vibration control system of Claim 1, wherein: said vibration damping device comprises a piezoelectric effect.

3. (original) The vibration control system of Claim 1, wherein: said vibration damping device comprises a piezoelectric actuator.

4. (original) The vibration control system of Claim 3, wherein:

said piezoelectric actuator comprises a piezoelectric stack.

5. (original) The vibration control system of Claim 3, wherein:

said piezoelectric actuator is made of a material selected from the group consisting of; lead-zirconate-titanate, lead-titanate, lead-zirconate, and barium-titanate.

6. (original) The vibration control system of Claim 1, wherein:

said vibration damping device disposed within the rotary machine further imparts a trans-axial reaction force to the rotor that is counter to the vibration of the rotor.

7. (original) The vibration control system of Claim 1, wherein:

said vibration damping device dampens the vibration of the rotor by at least 50-percent.

8. (original) The vibration control system of Claim 3, wherein:

said controller comprises:

a signal amplifier for receiving the vibration sensor signal and conditioning the signal;

an analog-to-digital converter for digitizing the conditioned signal;

a digital signal processor for further conditioning the digitized signal;

a control algorithm for calculating an output signal based on the input signal from said digital signal processor;

a digital-to-analog converter for converting the output signal into an analog response signal; and

a piezoelectric amplifier for conditioning the analog response signal.

9. (original) The vibration control system of Claim 1, further comprising:

an active vibration control system wherein said vibration damping device comprises an actuator having at least one gain constant.

10. (currently amended) A rotary machine having a vibration control system for controlling vibrations resulting from an excitation force acting upon the rotary machine, comprising:

a rotor bearing housing;

at least one bearing supported within said rotor bearing housing;

a rotor rotatably disposed adjacent said at least one bearing;

at least one sensor disposed within the rotary machine to sense vibration of said rotor;

at least one vibration damping device disposed proximate said at least one bearing to dampen the vibration of said rotor; and

a controller arranged in operable communication with said at least one sensor and said at least one vibration damping device, said controller adapted to receive a sensor signal from said at least one sensor and to send a control signal to said at least one vibration damping device, wherein the control signal to said at least one vibration damping device is adapted to adjust an excitation of said at least one vibration damping device based ~~on a difference between the vibration of the rotor sensed by said at least one sensor and an output response of the rotor vibration calculated by said controller~~ <u>upon the following relationship</u>

<u>H(s) = X1(s) / F(s);</u>

<u>wherein H(s) is a system transfer function, X1(s) is a calculated system output response and F(s) is a vibration frequency input based upon said sensor signal.</u>

11. (original) The rotary machine of Claim 10, wherein:
said at least one vibration damping device comprises a piezoelectric effect.

12. (original) The rotary machine of Claim 10, wherein:
said at least one vibration damping device comprises a piezoelectric actuator.

13. (original) The rotary machine of Claim 12, wherein:
said piezoelectric actuator comprises a piezoelectric stack.

14. (original) The rotary machine of Claim 12, wherein:
said piezoelectric actuator is made of a material selected from the group consisting of; lead-zirconate-titanate, lead-titanate, lead-zirconate, and barium-titanate.

15. (original) The rotary machine of Claim 10, wherein:
said at least one bearing comprises at least one bearing pad and further comprising at least one bearing support pin disposed between said at least one vibration damping device and said at least one bearing pad.

16. (original) The rotary machine of Claim 10, wherein:
said at least one bearing is selected from the group consisting of; bearing pad, tilting pad, journal bearing, roller bearing and ball bearing.

17. (currently amended) A method for damping the vibration of a rotor in a rotary machine, comprising:
sensing the vibration of the rotor;
communicating the sensed rotor vibration to a vibration damping device; and

damping the vibration of the rotor based ~~on a difference between the sensed vibration of the rotor and a calculated output response of vibration of the rotor~~ upon the following relationship

$H(s) = X1(s) / F(s)$;

wherein H(s) is a system transfer function, X1(s) is a calculated system output response and F(s) is a vibration frequency input based upon a sensed vibration signal.

18. (original) The method of damping set forth in Claim 17, wherein said communicating the sensed rotor vibration to a vibration damping device, further comprises:

communicating the sensed rotor vibration to a piezoelectric actuator.

19. (original) The method of damping set forth in Claim 18, wherein said communicating the sensed rotor vibration to a piezoelectric actuator, further comprises:

amplifying the vibration sensor signal;

converting the amplified signal from an analog signal to a digital signal;

processing the digital signal in preparation for analysis;

calculating a counter-vibration response signal from the processed signal;

converting the response signal from a digital signal to an analog signal; and

conditioning the analog signal for use by the piezoelectric actuator.

20. (original) The method of damping set forth in Claim 19, wherein said damping the vibration of the rotor, further comprises:

applying the counter-vibration response signal to the piezoelectric actuator;

vibrating the piezoelectric actuator at a frequency similar to the rotor vibration frequency.

21. (cancelled)

22. (currently amended) A vibration control system for a rotary machine having a rotor, comprising:

means for sensing vibration of the rotor;

means for calculating a counter-vibration response signal based ~~on a difference between the sensed vibration of the rotor and a calculated output response of vibration of the rotor~~ upon the following relationship

H(s) = X1(s) / F(s);

wherein H(s) is a system transfer function, X1(s) is a calculated system output response and F(s) is a vibration frequency input based upon a sensed vibration signal; and

means for generating a counter-vibration force based on the counter-vibration response signal for damping the vibration of the rotor.

23. (cancelled)